PETITION TO LIST GEORGIA BASIN POPULATIONS OF CHINA ROCKFISH (*SEBASTES NEBULOSUS*) AND TIGER ROCKFISH (*SEBASTES* NIGROCINCTUS) AS ENDANGERED OR THREATENED SPECIES UNDER THE ENDANGERED SPECIES ACT (ESA)

TO: SECRETARY OF COMMERCE, UNITED STATES DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE

From: Sam Wright (Petitioner), 1522 Evanston Ct., NE, Olympia, Washington, 98506 (360-943-4424, sam.wright@att.net). Petitioner is a fish biologist with 45 years experience in managing fish populations and fish habitat.

Subject: Petition the Secretary of Commerce to list as Endangered or Threatened the Georgia Basin populations of China rockfish (*Sebastes nebulosus*) and tiger rockfish (*Sebastes nigrocinctus*) and to designate critical habitat.

These two species of rockfish in the Georgia Basin have never been subjected to a formal status review for potential ESA listing. They were included in a 1999 Petition but only the three most common rockfish species were selected for status reviews. This resulted in the following report: Stout, H.A., B.B. McCain, R.D. Vetter, T.L. Builder, W.H. Lenarz, L.L. Johnson, and R.D. Methot. 2001. Status review of copper rockfish, quillback rockfish, and brown rockfish in Puget Sound, Washington. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-46, 158 p.

More recently, status reviews have been conducted for five additional rockfish species in the Georgia Basin, resulting in the following report: Biological Review Team. 2008. Preliminary scientific conclusions of the review of the status of 5 species of rockfish: bocaccio (*Sebastes paucispinis*), canary rockfish (*Sebastes pinniger*), yelloweye rockfish (*Sebastes ruberrimus*), greenstriped rockfish (*Sebastes elongatus*) and redstripe rockfish (*Sebastes proriger*) in Puget Sound, Washington. Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle WA.

During this same time frame, the Washington Department of Fish and Wildlife (WDFW) completed a comprehensive assessment of all rockfish species in the Georgia Basin and produced the following report: Palsson, W.A., T.S. Tsou, G.G. Bargmann, R.M. Buckley, J.E. West, M.L. Mills, Y.W. Cheng, and R.E. Pacunski. 2009. The biology and assessment of rockfishes in Puget Sound. WDFW Fish Management Division, Fish Program, Olympia WA.

Petitioner carefully reviewed content of the three above referenced documents plus additional relevant information. It was concluded that two additional species – China rockfish and tiger rockfish – would qualify for ESA listing as Threatened or Endangered. This would be an ideal time to conduct a status review of these two species since most of the required assessment work has already been done and there is an existing Biological Review Team (BRT). In addition, this would complete a comprehensive status review of all potential candidates for ESA listing among the Georgia Basin rockfish species.

The case for ESA listing of these two species will be presented in terms of three interrelated problems – a small home range and low productivity problem, a low abundance problem, and a depensatory mortality problem.

Small Home Range and Low Productivity Problem

WDFW, in their Revised Draft Puget Sound Rockfish Conservation Plan, has classified both species as part of a Nearshore Sedentary Rockfish Assemblage that also includes copper, quillback, brown and vermilion rockfish. Their definition of the assemblage (p. 61) is "Species in the **nearshore sedentary** assemblage that lives in close association with rocky habitats usually in nearshore waters less than 40 meters (120 feet) in depth and, as adults, have high site fidelity." WDFW states that: "Because it would be expensive or impossible to assess and manage every species of rockfish, WDFW will use the concept of an **indicator species** to represent one or several species within each assemblage." It is obvious that WDFW does not recognize any conservation problem for China and tiger rockfish since copper and quillback rockfish are proposed as the indicator species and criteria No. 4 for selecting indicator species states: "Has been identified at extreme low levels of abundance." For the Deepwater Assemblage, bocaccio, yelloweye rockfish and canary rockfish are all proposed as indicator species.

Based on Hoenig (1983) and Gunderson and Vetter (2006), Palsson et al. (2009:Table 3-2) give life history characteristics for the two species:

Mean age at maturity (yr) China 4-5, tiger, none given
Mean maximum age (yr) China 79+, tiger 116
Mean maximum size (cm) China 45, tiger 61
Mean natural mortality rate (%) China 5, tiger 4

For China rockfish, Wikipedia reports that "Adults are solitary and territorial, preferring rocky outcrops with boulder fields and crevices. When confronted with an intruder, the fish erect its spines and try to look larger. The territories are apparently small, with a study off Vancouver Island finding Chinas moving only within 10 m (33 ft). They feed on benthic organisms, including brittle stars, chitons, and crustaceans such as crabs and shrimp."

Wikipedia reports that the tiger rockfish "is a fish found in rocky reefs and boulder fields" and that "It is said that this species of fish may be somewhat territorial, and somewhat aggressive in certain cases. The fish lurks between crevices in rocks, and coral reefs." The 1999 Petition had the following comment: "Note: not much is known regarding the tiger rockfish, but they may be the most extreme example of small home ranges. They are extremely cryptic and only inhabit very rocky reefs." Palsson et al. (2009:4-10) state: "Tiger rockfish are also associated with complex and wall habitats (Murie et al. 1994)".

Both species do not attain a large size throughout their life and this makes them available to lingcod, the key top predator of their rocky reef marine fish community. Wikipedia reports for China rockfish: "Maximum reported size is 45 cm (18 inches)." They also report: "The tiger rockfish reaches a maximum length of 16 inches."

The extreme security importance of a small home range is that it enables certain rockfish species to have some of the lowest annual natural mortality rates of any species on earth, including humans. Palsson et al. (2009:6-50) report that China rockfish can "live up to 78 years in Alaska (Table 6.4, Munk 2001) and are a Very Low Productivity stock." Palsson et al. (2009:6-49) report that the tiger rockfish "is a very long-lived species that can live up to 116 years (Table 6.4, Munk 2001). Because of this longevity, it is a Very Low Productivity species." Wikipedia reports for tiger rockfish that "Scientists have dated some fish to be up to 166 years old. This species is very vulnerable, with a minimum population doubling time of 14 years."

Low Abundance Problem

Palsson et al. (2009:6-50) report for China rockfish: "They were occasionally caught by recreational fishers in North Sound but never comprised more than 1% of the rockfish catch, on average (Table 5.7). Their average occurrence of less than 0.1% in the South Sound recreational catch is suspect to be a misidentification because other information indicates they typically occur close to the ocean and have not been positively identified in South Sound (see Table 3.1). *They were not encountered during any recent WDFW surveys.*" (emphasis added). Note: it is believed that the last statement applies to both North and South Puget Sound.

Palsson et al. (2009:6-49) report for tiger rockfish: "Tiger rockfish were rare in recreational catches, comprising 0.4% of the average recreational rockfish catch in North Sound and less than 0.1%, on average, in South Sound (Table 5.6). *They are not frequently encountered during surveys but are observed during winter surveys for lingcod in the San Juan Islands* (WDFW, unpublished data)." (emphasis added) The 1999 Petition stated: "The most noticeable declines have been with tiger, canary and yelloweye rockfish."

During the 12 year period, 1975-1986, recreational fishery catches by species in Puget Sound were reported in published Washington Department of Fisheries (WDF) statistics. The China rockfish catch totaled 7,796 fish for the 12 year period in North Puget Sound (Areas 5-7) with catches reported in 11 of 12 years. The total reported catch in South Puget Sound (Areas 8-13) was only 275 fish for the 12 year period, with catches reported in 4 of 12 years. For tiger rockfish, the 12 year total for North Puget Sound was 1,824 fish, with catches being reported in 11 of 12 years. No catches were reported for tiger rockfish in South Puget Sound for any year in the 12 year period.

The most informative data on current abundance of the two species in U.S. waters of the Georgia Basin comes from SCUBA surveys reported in the NGO REEF (www.reef.org) data base. For China rockfish, the year-area combinations with a minimum of one fish observed were as follows (thru 12-31-09):

1998 Bainbridge Island	20 surveys, fish seen in 1, density 1
1999 San Juan Is. (including Henry)	1 survey, fish seen in 1, density 2
1999 Hood Head – Dungeness Bay	31 surveys, fish seen in 1, density 3
2000 Hood Head – Dungeness Bay	18 surveys, fish seen in 1, density 3
2001 Vashon Island	16 surveys, fish seen in 2, density 1
2001 Tacoma Area	56 surveys, fish seen in 2, density 1
2002 Hood Head – Dungeness Bay	15 surveys, fish seen in 1, density 3
2003 Vashon Island	17 surveys, fish seen in 2, density 2
2004 Port Susan and Possession Sound	21 surveys, fish seen in 2, density 1
2005 Orcas Island	33 surveys, fish seen in 1, density 2
2006 Orcas Island	95 surveys, fish seen in 3, density 2.3
2006 Quatsap Pt., Misery Pt., Potlatch	99 surveys, fish seen in 1, density 3
2007 Port Susan and Possession Sound	21 surveys, fish seen in 1, density 3
2007 Bainbridge Is.	15 surveys, fish seen in 1, density 2
2009 Dungeness Bay – Kydaka Point	14 surveys, fish seen in 2, density 1
2009 San Juan Is. (including Henry)	23 surveys, fish seen in 1, density 1

For tiger rockfish, the year-area combinations with a minimum of one fish were:

1998 Orcas Is.	3 surveys, fish seen in 2, density 1.5
1998 Lopez Is.	14 surveys, fish seen in 1, density 1

1999 Edmonds	46 surveys, fish seen in 1, density 2
2000 Orcas Is.	3 surveys, fish seen in 1, density 2
2001 Orcas Is.	9 surveys, fish seen in 1, density 1
2001 Tacoma Area	56 surveys, fish seen in 1, density 1
2001 Kitsap Peninsula, Port Gamble, Gig Harbor	18 surveys, fish seen in 1, density 2
2002 Orcas Is.	8 surveys, fish seen in 2, density 2
2002 San Juan Is. (including Henry)	33 surveys, fish seen in 1, density 1
2004 Orcas Is.	32 surveys, fish seen in 7, density 1.7
2004 San Juan Is. (including Henry)	22 surveys, fish seen in 2, density 1.5
2005 Orcas Is.	33 surveys, fish seen in 2, density 1
2005 Shaw Is.	1 survey, fish seen in 1, density 1
2005 Quatsap Pt., Misery Pt., Potlatch	36 surveys, fish seen in 2, density 2
2006 Orcas Is.	95 surveys, fish seen in 6, density 2
2006 Shaw Is.	9 surveys, fish seen in 4, density 1
2006 Stuart Is., Spieden Is.	3 surveys, fish seen in 1, density 1
2007 Orcas Is.	37 surveys, fish seen in 6, density 1.5
2008 Orcas Is.	26 surveys, fish seen in 1, density 1
2008 Whidbey Is.	157 surveys, fish seen in 1, density 1
2008 Dungeness Bay – Kydaka Pt.	40 surveys, fish seen in 3, density 1
2009 Orcas Is.	25 surveys, fish seen in 1, density 2
2009 San Juan Is. (including Henry)	23 surveys, fish seen in 5, density 1.2
2009 Stuart Is., Spieden Is.	29 surveys, fish seen in 1, density 1
2009 Sucia Islands	3 surveys, fish seen in 1, density 2
2009 Lopez Is.	12 surveys, fish seen in 1, density 1

Depensatory Mortality Problem

China rockfish and tiger rockfish in the Georgia Basin have the serious twin problems of very small home ranges and extremely low levels of abundance. Since the two previous problem descriptions indicate that both species show definite symptoms of potential depensatory mortality factors, this term and its serious implications need to be examined in some detail. When any fish population is subjected to depensatory mortality factors, it can only decline in abundance *as increased percentages of the population are lost.* It will either be driven to extinction or will stabilize at a very low level of abundance from which it cannot recover. In the past, all determinations of depensatory mortality have been made after-the-fact (when everyone can agree). Likely mechanisms for these two species are failure to find mates, hybridization with other species, and increased exposure to predation risk when they leave the security of their home ranges to seek mates.

Five key references to consider in examining this potential problem are the following:

Frank, K.T., and D. Brickman. 2000. Allee effects and compensatory population dynamics within a stock complex. Can. J. Fish. Aquat. Sci. 57:513-517.

Liermann, M., and R. Hilborn. 1997. Depensation in fish stocks: a hierarchic Bayesian meta-analysis. Can. J. Fish. Aquat. Sci. 54:1976-1984.

Myers, R.A., N.J. Barrowman, J.A. Hutchings, and A.A. Rosenberg. 1995. Population dynamics of exploited fish stocks at low population levels. Science 269:1106-1108.

Peterman, R.M. 1977. A simple mechanism that causes collapsing stability regions in exploited salmonid populations. Jour. Fish. Res. Bd. Can. 34:1130-1142.

Walters, C., and J. Kitchell. 2001. Cultivation/depensation effects on juvenile survival and recruitment: implications for the theory of fishing. Can. J. Fish. Aquat. Sci. 58:39-50.

The SCUBA survey data show many observations of single fish in full surveys. Even counts of 2 or 3 fish in full surveys could only be reproductively effective if they contain both a mature male and a mature female. Both species are brightly colored and have distinctive characteristics that easily separate them from other rockfish species. Due to their extreme longevity, rockfish can still be present at very low levels of abundance long after they have become functionally extinct.

Resource Management Changes

WDFW recently banned retention of all rockfish species in the Georgia Basin and limited recreational fishing for other marine fish (except lingcod and halibut) to waters inside the 20 fathom line. The latter change was to protect three species from the Deepwater Assemblage (bocaccio, yelloweye and canary rockfish) that are proposed for ESA listing. Future fishing mortality from bycatch will now be concentrated on the Nearshore Sedentary Assemblage – which includes China and tiger rockfish. A great deal of interest is already developing to again allow retention of rockfish to prevent “wastage” and provide “information” for managing the resources. If the conservation problem with China and tiger rockfish is not formally recognized by ESA listing, their retention will probably be allowed in the near future.

Conflicting Opinions on Distribution of China and Tiger Rockfish

Based on Miller and Borton (1980), Palsson et al. (2009:Table 3.1) presented the following numbers of historical records for the two species:

China: East Juan de Fuca (2), San Juan Islands (1), Puget Sound General (1)

Tiger: San Juan Islands (13), Central Sound (1), Puget Sound General (1)

This led to the following conclusion with respect to China rockfish (Palsson et al.:4-16): “Blue, vermilion, and China rockfishes are generally limited to the western Strait of Juan de Fuca with few records east of Port Angeles (Miller and Borton 1980, Table 3.1)”. For tiger rockfish, they state: “Tiger rockfish uncommonly occurs in rocky habitats in the San Juan Islands (Miller and Borton 1980, Table 3.1) and presumably occurs in the Strait of Juan de Fuca.”. The SCUBA survey data presented previously shows that both species are much more widely distributed in both North and South Puget Sound, albeit at very low abundance levels in all locations.

Critical Habitats

Palsson et al. (2009:4-11) provide the following description of critical habitats: “The primary habitat for nearshore rockfish is composed of pebble, cobble, boulder, bedrock, and hardpan substrates that are continuous or isolated and form crevices and other structures to protect rockfish from currents and predators (Matthews 1990a,b,c, Buckley 1997, Pacunski and Palsson 2002). In shallow waters of less than 18 m, rocky habitats are typically covered with macroalgae including canopy and understory kelps, bladed and filamentous red and brown algae, and, in high energy environments, surfgrasses (Mumford 2007). These formations are critical and essential to the health of juvenile and adult rockfishes as described above. Demersal species that use these habitats include copper, quillback, brown, and tiger rockfishes.” As noted in the previous section, this would also apply to China rockfish.